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# PATENT SPECIFICATION



Convention Date (Germany) : Dec. 22, 1924.

245,134

Application Date (in United Kingdom) : Dec. 22, 1925. No. 32,321 / 25.

Complete Accepted : Feb. 10, 1927.

## COMPLETE SPECIFICATION.

### Rotor Utilising the Magnus Effect for Working in Gaseous or Liquid Media.

I, JACOB EMIL NOEGGERATH, of Burggrafenstrasse 12, Berlin, Germany, a citizen of the United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to rotors utilising the Magnus effect for working in gaseous or liquid media, and has for its object to provide an improved rotor of this kind.

The labours of Professor Prandtl are known relating to the power-action of rotating cylinders and the use of the same as ships' sails in the invention of Anton Flettner.

It has been found that in addition to the main power component exerted, auxiliary power components can be added for the purpose of the greater difference of speed of the fluid branches flowing along both sides of the rotor, and auxiliary surfaces may be added which by a Magnus effect increase the action of the main surfaces.

The present invention consists in a rotor of the above mentioned kind in which the action is increased by the use of surfaces adapted to utilise the laws of viscosity, and in which the distance between any two adjacent projecting surfaces amounts to at least from 4 to 7 times their depth, these relations having been brought to light by my researches on this subject.

The Flettner discs at the end of the rotors only add a slight amount of power in the direction of the main action; essentially they only hinder the flowing away of the air and therewith a considerable part of the main power action is lost.

The invention serves generally for the

transformation of the "stream" energy or power into another form of energy or power, such for instance as for propulsion, lifting, or raising aeroplanes. It is for example applicable to the propulsion of vehicles of any desired kind, to the driving of vehicles of any kind whatsoever, of the driving of power machines (wind wheels) or to apparatus corresponding to screw pumps for placing under pressure liquids and gases, and so forth. The primary motion of liquids and gases is, in the sense of the invention, indicated by the word "stream."

The additional surfaces lying in the region of the main surface, or of the main part of the same, can be either adapted to rotate, or be stationary, and, for example, may be controlled by the stream. The stationary surfaces might serve for the purpose of clearing or screening the main or auxiliary surfaces, and in fact might do so in a variable manner, so that the intensity of the power or its direction is altered by variation of the clearing, screening, or uncovering affect.

Finally, the power-rotors can also be used as steering devices for vehicles, especially ships and aircrafts, and as devices for giving air-power engines the proper direction relatively to the wind. These rudders again can themselves be controlled by stationary surfaces or rotors.

In the accompanying drawings the full line arrows indicate the direction of the power in the plane of the drawing, the broken line arrows the direction of the gas (air) or liquid, thus of the stream; likewise the rings and rings surrounding dots indicate the direction of the power perpendicular to the plane of the drawing, the broken line rings, as also the broken line rings which enclose a dot,

the direction of the stream perpendicular to the plane of the drawing.

Fig. 1 is a side view, and

Fig. 2 a plan of a rotating cylinder with rotating surfaces additional to the main surface, with which the viscosity laws are applied; i.e. the distance between the auxiliary surfaces is at least four to seven times as great as their depth.

The same holds good from the view in Fig. 3 and the corresponding plan in Fig. 4, but it is to be noted that the corrugations shown in Fig. 3 are not drawn to scale to accurately illustrate this law. The same law likewise holds good for the view in Fig. 5 and the corresponding plan in Fig. 6.

This construction shows also the natural mechanical stiffening, which indicates a further advantage relatively to the simple cylinder. On account of the additional surfaces the main action is enhanced, apart from the checking of the waste stream.

Hence for the same work done a lower peripheral speed is necessary. For the purpose of a more considerable enhancement of the action, the peripheral speed with such constructions can easily be raised, as far as mechanical considerations are concerned, above that of the usual construction with such cylindrical rotors.

Figs. 5 and 6 show further means for increasing the effect by making the transverse dimensions at the periphery different relatively to the vicinity of the axis.

Figs. 7 and 8 show two views of a rotor-propeller or wind-wheel with rotors according to the invention. The forces working upon the conical surfaces oppose the centrifugal force to which the conical rotors are exposed in the direction of their own axes on rotating round the axis 1. By rotating this device round its central axis and the rotor elements round their respective axes, a propeller action is attained, larger than in a usual propeller. By exposing the device to a fluid stream and rotating the rotor elements round their respective axes the entire device comes into rotation around the main axis and has the effect of a windmill.

In order to utilise in a most effective manner the laws of viscosity the rotors can be provided with auxiliary surfaces arranged at an angle to their axes.

The auxiliary surfaces can be placed at different parts of the rotor at different slanting positions or have different dimensions.

When using a stationary arrangement

of the auxiliary surfaces the cross sections can be arranged so as to increase upon the side where the rotor and the stream move in the same direction, and to decrease on the other side.

The position of the auxiliary surfaces can be made changeable automatically or otherwise relatively to the main surface during the operation or during one revolution of the rotor.

Figs. 9 and 10 show two views of a supporting surface, a propeller, or a sail surface, on rotating main and auxiliary surfaces constructed in accordance with the invention.

The stationary surface 4 can be controlled at the end by the rudder 5.

Figs. 11 and 12 show the application of my rotors in an inclined position to a "glider" craft, whereby in addition to the main power component a buoyancy effect is obtained.

Fig. 13 shows screw-like rotary bodies which expand a part of the stream and compress other parts of the same, as the form shown in this example in symmetric to the axis of the stream; that is to say, the cylinder is provided with vanes or the like helically arranged upon it, some with a right hand and others with a left hand pitch.

Fig. 14 shows the control or steering of a ship by means of power-rotors, which are arranged on the stem and on the stern of the ship and are built according to any of the Figs. 1, 3, 5, 9 or 13.

Figs. 15 and 16 show two views of an aircraft driven by a propeller and which is lifted by the rotation of similar rotors 9 and 10, arranged in tandem for example, with the aid of the wind due to the propeller acting upon said rotors and upon the aircraft body, which has the character of a supporting plane, such rotors being constructed on the lines illustrated in Figs. 1, 3, 5 and 13.

Figs. 17 and 18 show aircraft with, for example, lifting rotors according to my invention arranged in combination with a supporting plane on a usual body.

Rotors with disc surfaces can be arranged of such dimensions as to serve as a running wheel of an air craft, increasing at the same time the power action. Also they can be used to increase the lift of air crafts and to serve as floats for hydroplanes.

Rotors can also be used as controlling apparatus for power engines and as governing apparatus on movable power engines, for example, on rotatable power engines for their adjustment in the direction of the stream.

Rotating or stationary surfaces influenced by the direction of the stream and

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- arranged in the manner of a rudder can be used as means for determining the position of a main rotor or surface or body.
- 6 It is to be noted that this invention, in addition to being applied to ordinary full size working craft, can also be applied to models of the same, and to toys.
- 10 Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—
- 15 1. Rotor utilising the Magnus effect for working in gaseous or liquid media and provided between the ends with at least two projecting surfaces, traversing the medium, hereby characterised, that
- 20 for utilising the laws of viscosity, the distance between any two adjacent projecting surfaces amounts to at least from 4 to 7 times their depth.
- 25 2. Rotor according to Claim 1, hereby characterised that the primary auxiliary surfaces are adjustable, at least partially, preferably by displacement or rotation.
- 30 3. Rotor according to either of the Claims 1 or 2, hereby characterised, that the main surface, or the auxiliary surfaces, or both, can be adjusted, for example by a rotor or by a stationary controlled element, for example, in the direction of a flowing stream.
- 35 4. Rotor according to any of the Claims 1 to 3, hereby characterised that the angle of inclination of the rotating auxiliary surfaces to the main surface is different at different places.
- 40 5. Rotor according to any of the Claims 1 to 4, hereby characterised that the rotors carry projecting gliding surfaces arranged at an angle to the axis of the rotor.
- 45 6. Rotor with disc surfaces according to any of the Claims 1 to 5, characterised by differences of the transverse dimension at the periphery relatively to the vicinity of the axis.
- 50 7. Rotor according to any of the Claims 1 to 6, hereby characterised, that the auxiliary surfaces have at different parts of the rotor different angular positions, or dimensions, or both.
- 55 8. Rotor according to any of the Claims 1 to 7, hereby characterised, that with a stationary arrangement of the auxiliary surfaces the stream, upon the side where the rotor and stream move in
- 60 the same direction, flows through an increasing cross section, and upon the other side through a diminishing cross section.
9. Rotor according to any of the Claims 1 to 8, hereby characterised, that the position of the secondary auxiliary surfaces can be automatically or otherwise changed relatively to the main surface during the operation or during one revolution.
- 65 10. Rotor according to any of the Claims 1 to 9, hereby characterised, that the angle of inclination of the rotors to the direction of travel, or of the wind, is an acute or an obtuse angle.
- 70 11. Rotor according to any of the Claims 1 to 10, hereby characterised, that it is arranged as a steering device in the manner of a rudder applied to a body exposed to a fluid stream, for example, for air or water craft.
- 75 12. Rotor with disc surfaces according to any of the Claims 1 to 11, hereby characterised that the intermediate discs of greater areas have greater diameters, for example, for the purpose of using them as a running wheel frame or for increasing the power action.
- 80 13. Rotor according to any of the Claims 1 to 12, hereby characterised, that it is arranged on an aircraft or watercraft, for furnishing an additional lift and the power rotor discs serve as floats.
- 85 14. Rotor according to any of the Claims 1 to 13, hereby characterised, that it serves as a controlling apparatus for power engines.
- 90 15. Rotor according to any of the Claims 1 to 14, hereby characterised, that it is arranged as a governing apparatus on power engines, which are arranged to be movable, for example, rotatable, for the purpose of adjustment in the direction of the stream.
- 95 16. Rotor according to any of the Claims 1 to 15, hereby characterised, that it is used on propellers or propulsion elements for liquids or gases.
- 100 17. Rotor according to any of the Claims 1 to 16, hereby characterised, that the position of the rotor or of the screening surfaces or bodies is determined by stationary or rotating surfaces arranged as a rudder and influenced by the direction of the stream.
- 105 18. Rotor according to any of the Claims 1 to 17, hereby characterised, that it is applied to toys.
- 110 19. Rotor according to any of the Claims 1 to 18, hereby characterised, that the rotary body carries screw threads, for example, in the shape of cams and grooves.
- 115 20. Rotor according to any of the Claims 1 to 19, hereby characterised, that the screw threads on the rotary body are of different angles running in opposite directions.
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21. Rotor according to any of the Claims 1 to 20, hereby characterised, that one or more additional stationary surfaces are embodied therein.

22. Rotor according to any of the Claims 1 to 21, hereby characterised, that the additional surfaces projecting from the main surface form with the latter a continuous wave-shaped surface, as seen in longitudinal axial section.

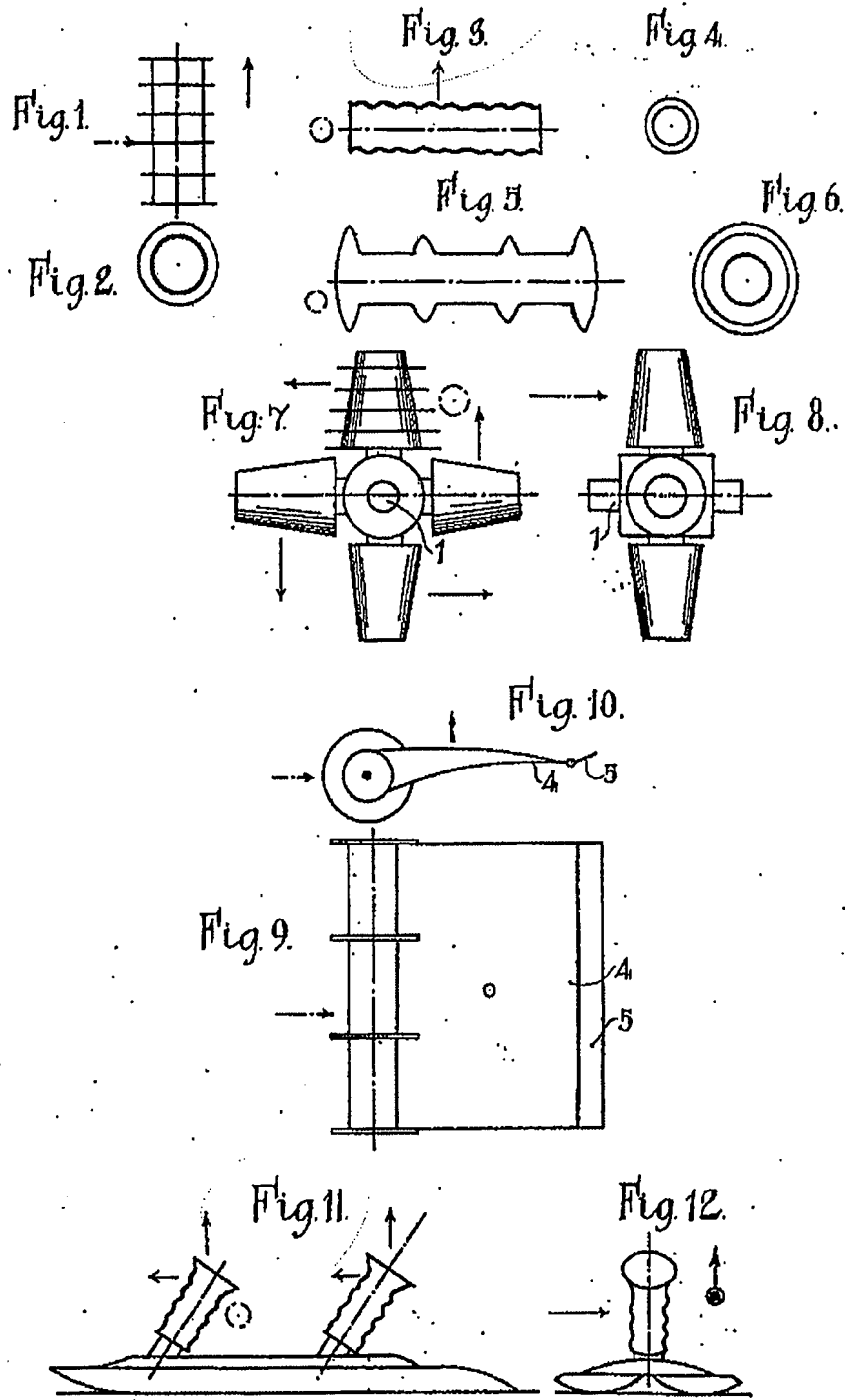
23. Rotor substantially as described and illustrated in the accompanying drawings.

Dated this 22nd day of December, 1925.

MEWBURN, ELLIS & Co.,  
70 & 72, Chancery Lane, London,  
W.C. 2,  
Chartered Patent Agents.

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[This Drawing is a reproduction of the Original on a reduced scale.]



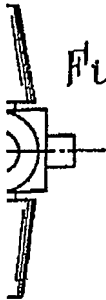
g 4.



Fig 6.



Fig 8.



12.



Fig 13.

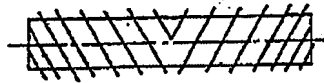


Fig 14.

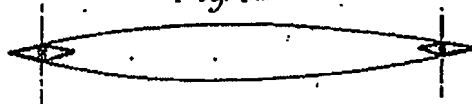


Fig 15.

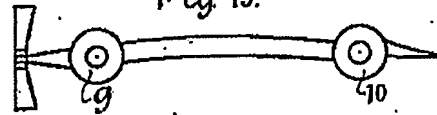


Fig 16.

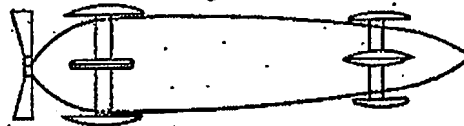


Fig 17.

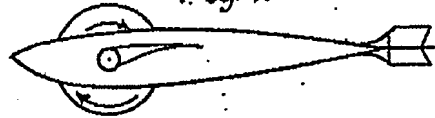
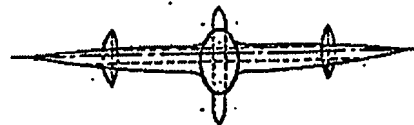
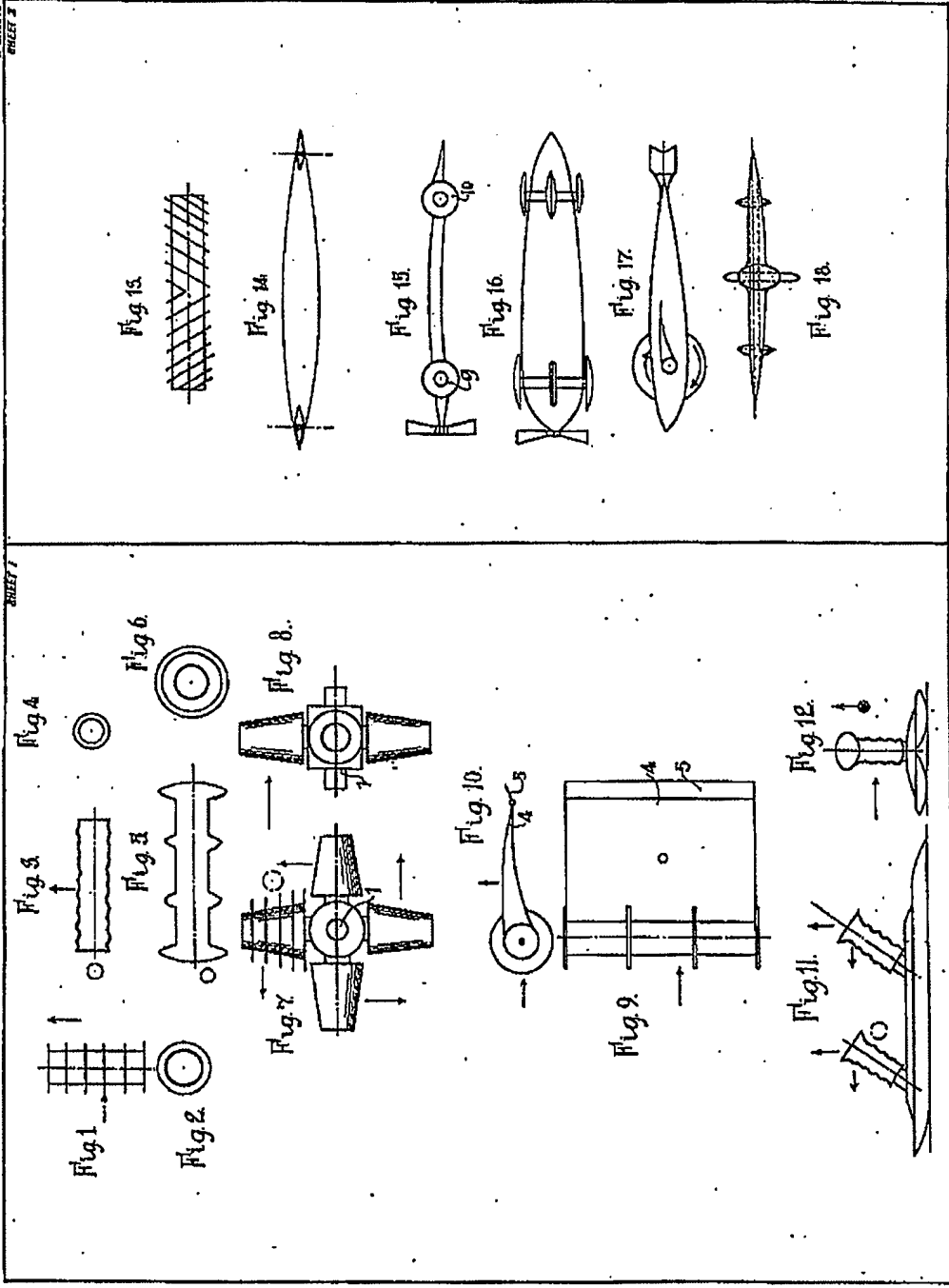


Fig 18.





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